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(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Water Saving Recirculating System

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(71) Same as inventor

(57) 3 Claims

Notice: This application is as filed and may therefore contain an incomplete specification.

ABSTRACT OF THE DISCLOSURE

The water saving recirculating system is incorporated into a conventional water supply having a hot water tank, a hot water faucet and a main line which runs from the tank to the faucet. The system includes a sensor which detects the temperature of water in the main line in the vicinity of the faucet. When the temperature is below a pre-determined value the sensor causes a valve to open to allow water to return to the hot water tank via a recirculating line. When the temperature is above that value the valve closes and a second valve opens to allow the water to flow to the hot water faucet.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A water saving recirculating system for use with a conventional water supply including: heating means for heating water to a temperature elevated above ambient temperature; a main water-carrying line extending from the heating means and terminating at an outlet remote from the heating means; a sensor for detecting the temperature of water in the main line in the vicinity of the outlet; a first valve disposed in the main line and opening to allow water to flow therethrough when the water temperature detected by the sensor exceeds a pre-determined value; a recirculating water-carrying line extending from the main line between the sensor and the first valve and terminating at the heating means; and a second valve disposed in the recirculating line and closing to prevent water from flowing therethrough when the water temperature detected by the sensor exceeds a pre-determined value.

2. A water saving recirculating system for use with a conventional water supply including: heating means for heating water to a temperature elevated above ambient temperature; a main water-carrying line extending from the heating means and terminating at an outlet remote from the heating means; means for opening and closing said outlet; a sensor for detecting

the temperature of water in the main line in the vicinity of the outlet; a recirculating water-carrying line in communication with the main line and terminating at the heating means; first and second valves disposed in the main line and recirculating lines respectively, said second valve being responsive to said sensor and to said outlet such that said second valve opens when the outlet is open and the temperature detected by said sensor is below a predetermined value to allow water to flow therethrough and closes when the temperature is above said value, said first valve opening when the outlet is open and the temperature is above the predetermined value.

3. A water saving recirculating system for use with a conventional water supply including: heating means for heating water to a temperature elevated above ambient temperature; a main water-carrying line extending from the heating means and terminating at an outlet remote from the heating means; means for opening and closing said outlet; a sensor for detecting the temperature of water in the main line in the vicinity of the outlet and for generating a signal when the temperature is below a predetermined value; a first valve disposed in the main line and being normally closed but opening in response to an increase in pressure differential of water thereon to a

predetermined value; a recirculating water-carrying line extending from the main line between the sensor and the first valve and terminating at the heating means; a pressure switch in circuit with said sensor and being normally open, said switch closing in response to a drop in pressure in said main line; a second valve disposed in the recirculating line and responsive to the pressure switch and to the signal generated by said sensor such that said second valve opens when said pressure switch is closed and when the sensor generates said signal to allow water to flow therethrough and closes when the sensor no longer generates said signal, the pressure of water in said main line dropping when water flows through said recirculating line but increasing to said predetermined value when the second valve closes to stop such flow, said first valve detecting such increased pressure and opening to allow water to flow to the outlet.

BACKGROUND OF THE INVENTION

This invention relates to a water saving recirculating system for use with a conventional water supply. More particularly the invention relates to a system for detecting whether water which is destined to be discharged from a hot water faucet is sufficiently hot. If it is not, the water is diverted from the faucet and re-circulated to a hot water tank.

When a hot water faucet is first opened the water which discharges from it is usually not hot. It is customary to allow the water to run until it reaches the desired temperature. During this time the water which discharges from the faucet flows down the drain and is wasted. Also wasted is the energy which is expended in heating the water and in pressurizing it so that it will reach the faucet.

A number of systems have been devised to re-use or recycle the water so that it is not wasted. Examples of such systems are described in the following Letters Patent of the United States: patent no. 5,261,443 to Walsh; patent no. 5,205,318 to Massaro et al.; no. 5,339,859 to Bowman; no. 5,277,219 to Lund; no. 4,697,614 to Powers et al.; no. 4,201,518 to Stevenson; no. 3,799,181 to Maddren; no. 4,331,292 to Zimmer; no. 4,936,289 to Peterson; no. 4,606,325

to Lujan; no. 4,450,829 to Morita et al.; no. 3,776,261 to Houghton; 5,009,572 to Imhoff et al.; no. 5,385,168 to Lund; no. 5,042,524 to Lund; no. 5,105,846 to Britt; and no. 4,945,942 to Lund.

Known systems for re-using or re-cycling water from a hot water faucet have a number of shortcomings. In some systems, unused water in the hot water line is circulated to the cold water line. While such water may not be sufficiently hot it may be warm and any heat which it has is wasted in the cold water line. Moreover the known systems require both a hot water and a cold water line and are usually not suitable where there is only one line such as in a packing plant or a factory where only hot water is required.

Many known systems have another disadvantage. Some require auxiliary pumps to continuously recirculate the water. Such pumps are costly and may malfunction. If the pumps malfunction the entire system will break down.

SUMMARY OF THE INVENTION

According to the present invention, water which is insufficiently hot in a hot water line is re-cycled to the hot water heater and not to the cold water line. The system is made up of relatively inexpensive and readily available components.

The invention may be broadly described as including heating means for heating water to a temperature elevated above ambient temperature; a main water-carrying line extending from the heating means and terminating at an outlet remote from the heating means; a sensor for detecting the temperature of water in the main line in the vicinity of the outlet; a first valve disposed in the main line and opening to allow water to flow therethrough when the water temperature detected by the sensor exceeds a pre-determined value; a recirculating water-carrying line extending from the main line between the sensor and the first valve and terminating at the heating means; and a second valve disposed in the recirculating line and closing to prevent water from flowing therethrough when the water temperature detected by the sensor exceeds a pre-determined value.

DESCRIPTION OF THE DRAWINGS

The water saving recirculating system of the invention is described with reference to the accompanying drawings in which:

Figure 1 is a schematic drawing of the system;

Figure 2 is a perspective view of the components which make up the system;

Figure 3 is a schematic view of the components illust-

rated in Figure 2 showing the direction of flow of water when its temperature is below a predetermined value; and

Figure 4 is another schematic view of the components showing the direction of flow of water when its temperature is at or above a predetermined value.

Like reference characters refer to like parts throughout the description of the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to Figure 1 water from a heating means such as a conventional hot water tank (not illustrated) flows through a main water-carrying line 10 to a probe 12. That probe is electrically connected to an adjustable temperature sensor 14. The sensor generates an electrical signal when the temperature at the probe is below a predetermined value.

Downstream of the probe is an electrical pressure switch 16 which detects a drop in pressure caused by the flow of water. When the pressure drops, switch 16 closes. That switch and probe 12 are connected in series in a circuit described below.

Water downstream of the pressure switch flows through one of two lines, main line 10a or recirculating line 18. Line 10a is an extension of the main line and runs to a first pressure sensitive valve 20. That valve is spring loaded and is normally closed but opens when the pressure differential of water between the upstream and downstream sides of the valve exceeds a predetermined value.

Downstream of valve 20 is a manually operated shut-off valve 22. Downstream of valve 22 is a faucet (not illustrated) which is the outlet from which water discharges at 24. Valve 22 may alternatively be the faucet. If valve 22 is a shut-off valve, it will normally be open but may be closed manually to shut down the main line entirely.

Water in recirculating line 18 flows to a second valve 28 which is activated by a solenoid 30. The solenoid is connected in series with sensor 14 and pressure switch 16. Provided switch 16 is closed, the signal which the sensor generates when the temperature at the probe is below a predetermined value will cause the solenoid to open valve 28. Water may then recirculate through line 18 and through a check valve 40 to the hot water tank.

With reference to Figure 2, a probe and sensor 12, 14 suitable for use in the system is sold under the trade mark

"Aquastat" and is described as a model no. L6008A Controller manufactured by the Honeywell Company of Minneapolis, Minnesota, U.S.A. The pressure switch 16 is widely available at plumbing outlets. Models 210CA and 211CA solenoid valves sold by Alco Controls Division of Emerson Electric Company of St. Louis, Missouri, U.S.A. are suitable for use as a solenoid and solenoid valve 30, 28. Valve 20 is described below and shut-off valve 22 is of conventional construction.

With reference to Figure 3 water in the main line 10 flows by probe 12 which monitors the temperature. If the temperature is below a predetermined value, sensor 14 generates an electrical signal. If pressure switch 16 detects movement of the water it will close and the signal will cause solenoid 30 to open valve 28 with resulting flow of water through recirculating line 18 and check valve 40. That water will discharge into the hot water tank. The pressure of water in line 10a is insufficient to overcome the bias of coil spring 42 of valve 20 and the valve is accordingly closed by ball 44 which is forced into the inlet of the valve by the spring.

With reference to Figure 4, the temperature of water is above the predetermined value and sensor 14 does not generate a signal. Valve 28 which is normally closed remains so since

there is no signal from the sensor to activate the solenoid.

Since valve 28 is closed, the pressure of water in lines 10 and 10a will increase. The pressure of the water on ball 44 will overcome the bias of coil spring 42 and cause valve 20 to open. Valve 22 is also open and water will discharge from outlet 24.

In operation, before the hot water faucet is opened, no water flows through main line 10, 10a because valve 20 is closed. No water flows through recirculating line 28 as well. That is because pressure switch 16 is open since it detects no movement in line 10. The circuit which activates solenoid 30 is likewise open and normally closed valve 28 remains closed.

When the hot water faucet is opened, the pressure on the upstream side of valve 20 reduces momentarily and the valve opens to allow a small quantity of water to flow through it. That flow of water is detected by switch 16 and the switch will close thereby closing the electric circuit from sensor 14 to the solenoid. The solenoid will now respond to a signal generated by the sensor.

Assuming that the temperature detected by the sensor is below a predetermined value, the sensor will cause the solenoid to open valve 28 and water will flow through the recirculating line and discharge into the hot water tank.

When the temperature of the water reaches the predetermined value, sensor 14 will no longer generate the signal necessary to keep valve 28 open and it will close. The pressure of water on valve 20 will accordingly increase and it will open and water will discharge from the hot water faucet.

When the faucet is turned off, water will cease flowing in the main line and switch 16 will open. Switch 16 will remain open as long as there is no movement of water in the main or recirculating lines.

Switch 16 thus prevents the water from beginning to flow through the recirculating line when its temperature falls. In the absence of such a switch, when the temperature of the water falls below the predetermined value, sensor will cause the solenoid to open valve 28 and water will begin to flow through the recirculating line. The flow in the line will stop when the water temperature exceeds the predetermined value but will resume whenever the water temperature is below that value.

It will be understood of course that modifications can be made in the preferred embodiments illustrated and described herein without departing from the scope and purview of the invention as defined in the appended claims.

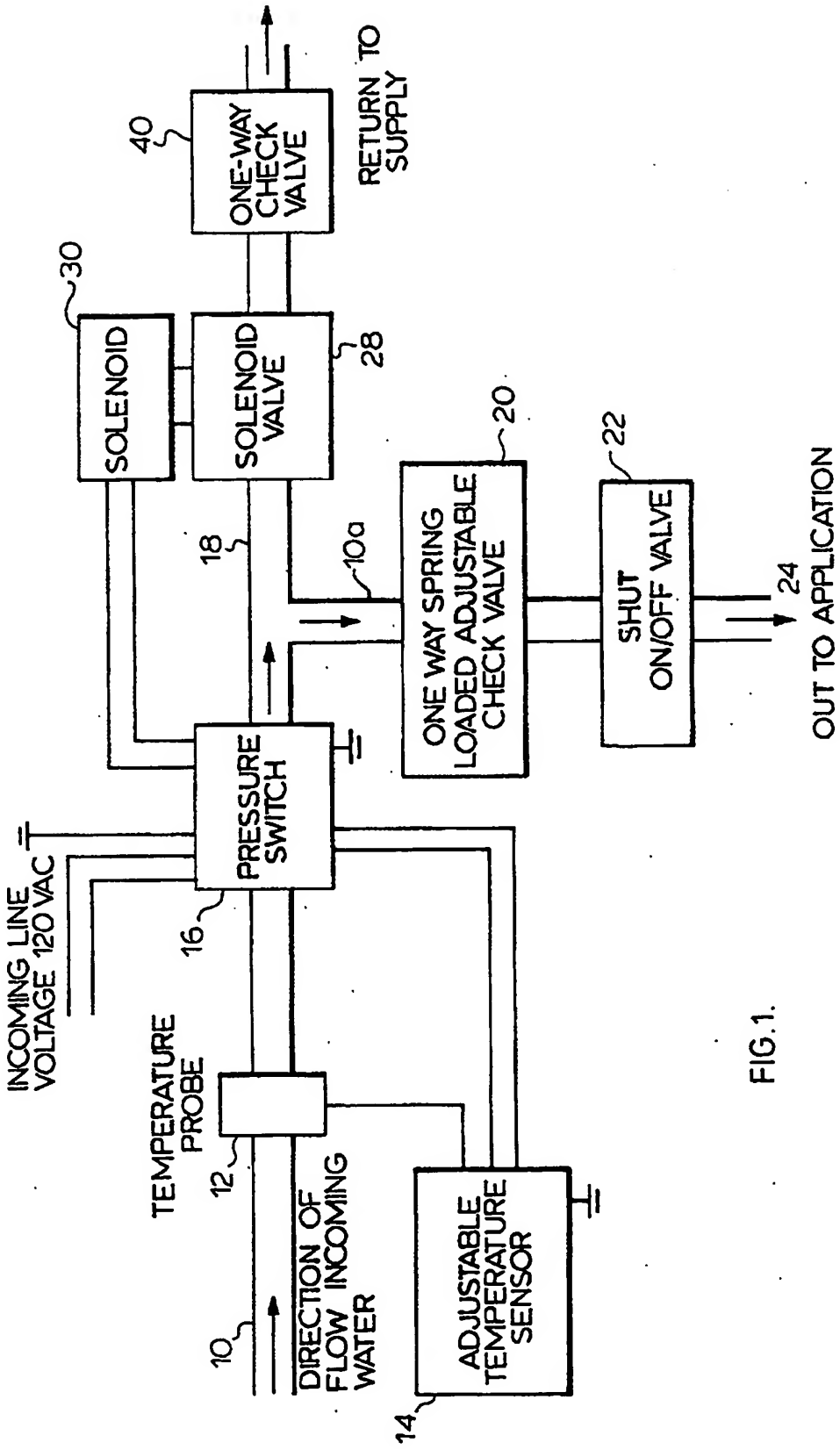
ONE-WAY CHECK VALVE
40
RETURN TO SUPPLY
30
SOLENOID
SOLENOID VALVE
28
18
10a
ONE WAY SPRING LOADED ADJUSTABLE CHECK VALVE
20
22
SHUT ON/OFF VALVE
24
OUT TO APPLICATION
PRESSURE SWITCH
16
INCOMING LINE VOLTAGE 120 VAC
TEMPERATURE PROBE
12
10
DIRECTION OF FLOW INCOMING WATER
ADJUSTABLE TEMPERATURE SENSOR
14

FIG.1.

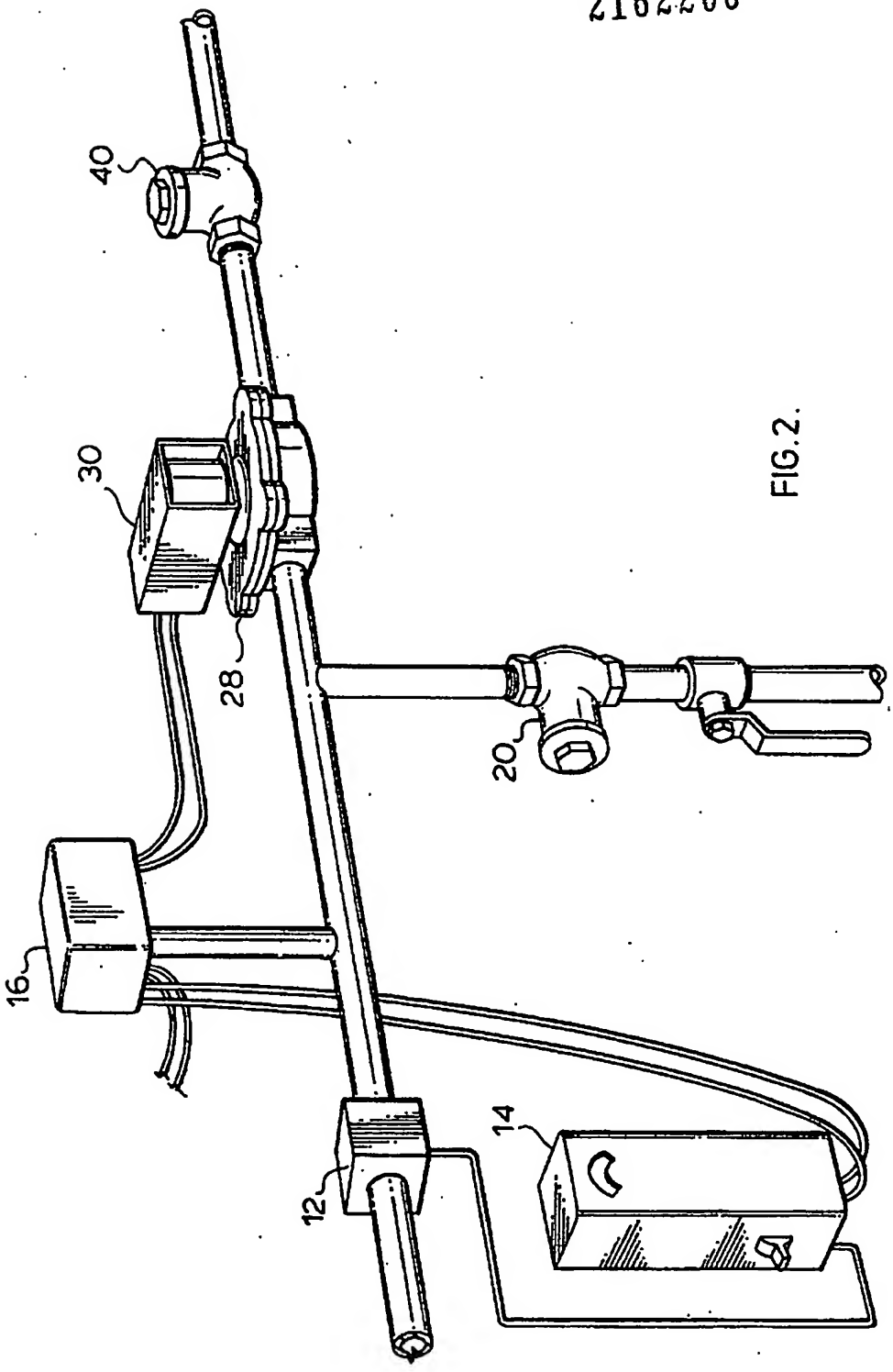

FIG.2.

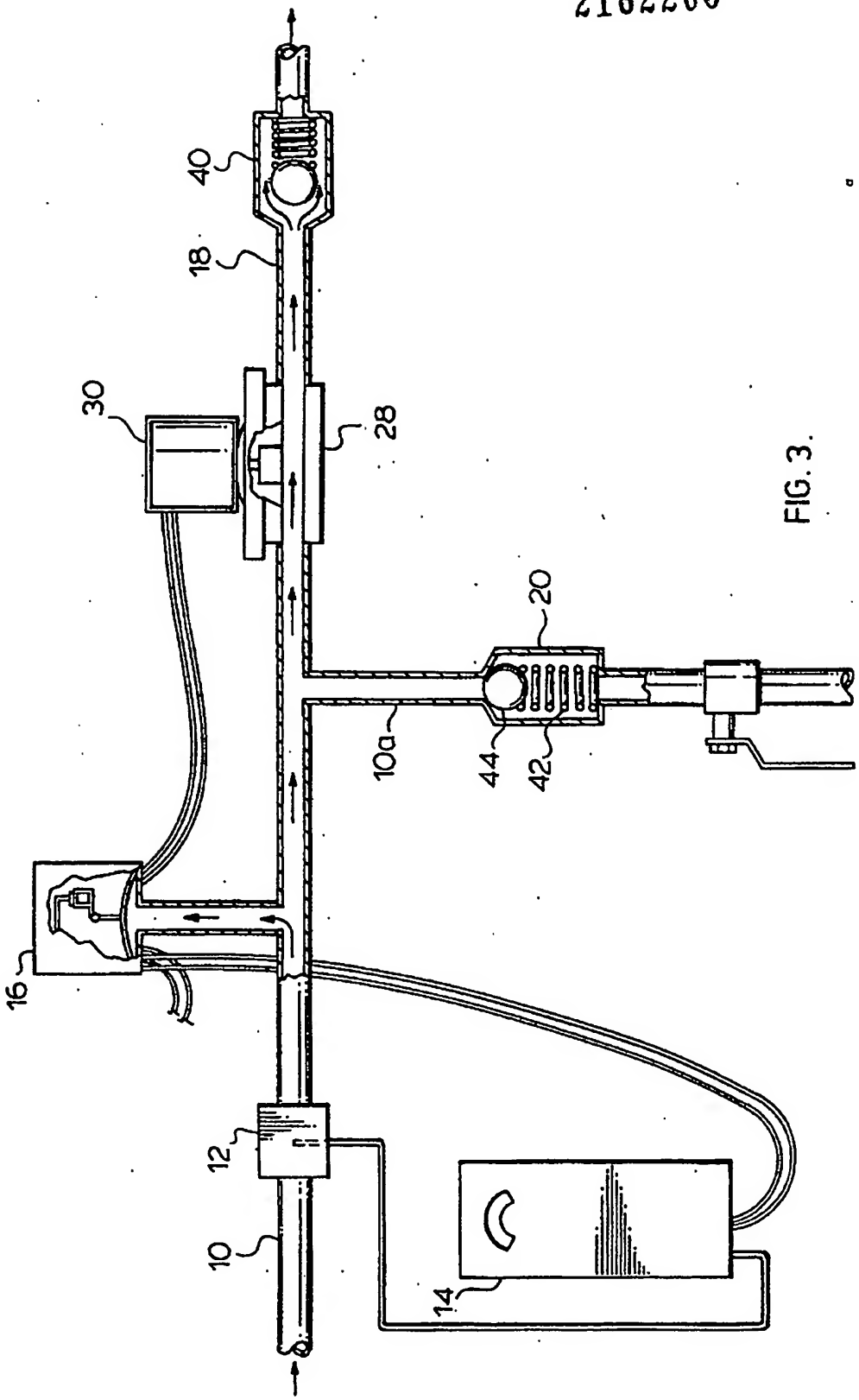

FIG. 3.

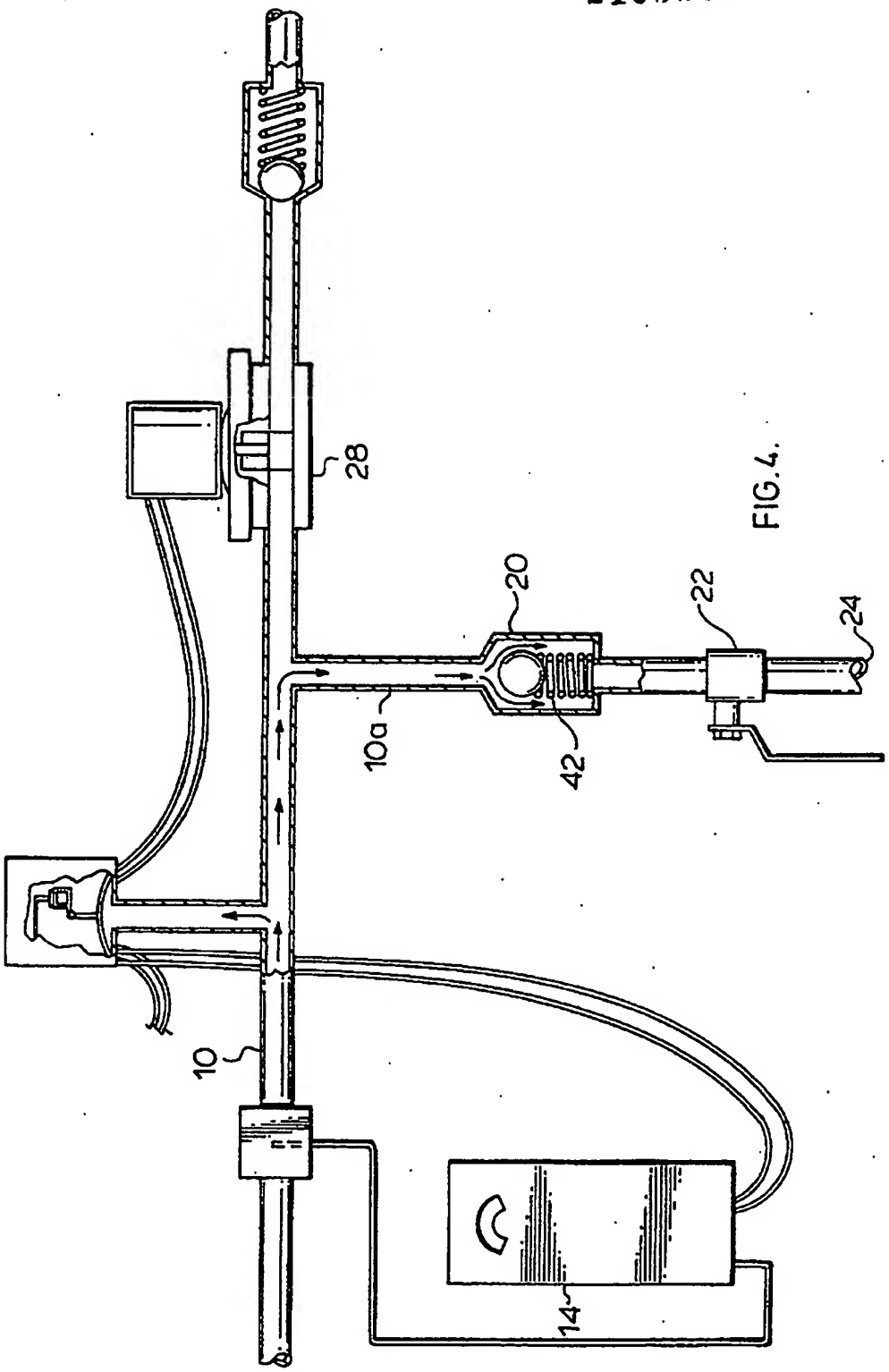

FIG.4.